EVOLVED EXPENDABLE LAUNCH VEHICLE (EELV)

DEVELOPMENT AND INITIAL LAUNCH SERVICES

REQUEST FOR PROPOSAL

ANNEX 6

SYSTEM PERFORMANCE REQUIREMENTS FOR DEVELOPMENT
(18 June 1998 Update)

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1. SCOPE

1.1 Purpose
This document identifies the Evolved Expendable Launch Vehicle (EELV) minimum system performance requirements and goals derived from the Air Force Space Command (AFSPC) EELV Operational Requirements Document (ORD).

1.2 Overview of EELV Program
The primary requirement of the EELV program is to execute the Government portion (DoD and NASA) of the National Mission Model at lower recurring costs than those of current expendable systems. The program should also maintain or improve reliability, capability, and operability.

1.3 Document Overview
This document, including its unclassified and classified Annexes, establishes performance and verification requirements for the development and deployment of the EELV system. It is intended to be the foundation for the Contractor prepared System/Segment/Subsystem Specifications. Section three contains the minimum system performance requirements. Requirements designated with an asterisk * denote Key Performance Parameters (KPP). Section four contains program objectives for system development and execution of the launch service.

1.4 Cost

Using current systems as a cost baseline, the total Life Cycle Cost and the annual fixed cost for launching the Government portion of the NMM shall be reduced by 25% (threshold) from those of current launch systems. An objective is a 50% reduction in these costs.

2. APPLICABLE DOCUMENTS AND DEFINITIONS

2.1 Reference Documents
EELV Payload Database Document
Air Force Space Command Operational Requirements Document for the EELV System

2.2 Definitions

2.2.1 System Description
The EELV system will be used to deploy Government payloads. The EELV system consists of the Launch Vehicle (LV) Segment and the Ground Segment. The EELV system includes all equipment, facilities, and launch base infrastructure necessary to launch a payload, place it in the required delivery orbit, provide specified environments, provide EELV system maintenance, and perform any necessary recovery/refurbishment operations. The major EELV system elements and external interfaces shall be defined and illustrated in the Contractor prepared system specification.

2.2.2 System Segments

2.2.2.1 Launch Vehicle (LV) Segment
The LV segment consists of the means for transporting the payload from the launch site to the delivery orbit, through completion of the contamination and collision avoidance maneuver (CCAM) and stage disposal. It includes, but is not limited to, production, assembly, propulsion, guidance and control, electrical power, tracking and telemetry, communication, ordnance, flight termination, payload separation, structural elements, payload fairing, software, and appropriate vehicle/ground and vehicle/payload interfaces that are necessary to meet mission requirements. The payload and its unique Airborne Support Equipment (ASE), though transported by the EELV, are not considered as part of the EELV system.

2.2.2.2 Ground Segment
The ground segment consists of all existing, modified or new construction, facilities, and the equipment, software, and utilities necessary to support the planning (mission, flight, and launch operations), storage, integration, check-out, processing, launch, telemetry, tracking and control through CCAM, and recovery/refurbishment (if any) for the EELV system.

2.2.3 System Functions

2.2.3.1 Manufacturing
Manufacturing includes production of all LV components, subsystems, and subassemblies.

2.2.3.2 Transportation
This function includes activities and procedures necessary to transport launch vehicle elements/subsystems/subassemblies from the manufacturing source to the launch site.

2.2.3.3 Receipt and Checkout
This function includes initial receipt, unloading, and checkout of launch vehicle elements/subsystems/subassemblies.

2.2.3.4 Launch Vehicle Storage
This function includes the capability to store launch vehicle elements/subsystems/subassemblies prior to use in the system.

2.2.3.5 Vehicle Element Processing
This includes the activities that are required for the assembly and test of the vehicle elements, such as the core, strap-on booster, and upper stage, from the various subsystems and subassemblies, such as tanks, structure, propulsion systems, and avionics.

2.2.3.6 Integration
Integration includes all the activities required to mate vehicle elements and payload to each other and includes the necessary tests to verify satisfactory mechanical and electrical interfaces among all elements and the launch facility.

2.2.3.7 Functional Testing
This function includes the activities required to verify the functionality of an EELV in the integrated condition. This function also includes the final checkout required prior to launch of the integrated fueled vehicle and payload.

2.2.3.8 Launch and Flight Operations
This function includes all activities necessary for launching an EELV, including flight planning, support for the ascent flight (including range safety related functions), payload delivery, and deorbit/maneuvering of vehicle components for disposal or recovery.

2.2.3.9 Recovery
This function includes the activities required for recovery and return of reusable components, if any, of the EELV after mission completion.

2.2.3.10 Refurbishment
This function includes activities required to refurbish ground equipment and facilities for reuse.

2.2.3.11 Subassembly Refurbishment Overhaul
This function includes rebuilding and repairing EELV subassemblies for reuse after failures during prelaunch processing, or after recovery of reusable components, if any.

2.2.3.12 Logistics Support
This function includes all activities necessary to provide a supportable design, integrate support requirements with readiness objectives, and maintain operational capability at minimum cost.

2.2.4 Standardization

Standardization is defined as the optimum use of standard pads, payload interfaces, flight hardware, ground hardware, infrastructure, facilities and processes.

3. KEY SYSTEM REQUIREMENTS

3.1 Capabilities Required (System and East Coast)

3.1.1 Performance

EELV shall have the ability to accurately deliver the government portion of the NMM missions to required orbit(s). The mission masses and required orbits are defined in Table 1. The complete NMM includes all DoD, intelligence, and civil expendable launch missions projected for EELV and serves as the consolidated national forecast of spacelift requirements for the future based on documented customer (payload) needs.

3.1.1.1 Performance (Mass-to-Orbit)*

The threshold requirement is to deliver the required mass to the desired orbit of the payloads indicated in Table 1 to include all classified payloads (reference classified SPRD Addendum). The EELV shall have the capability to inject into geosynchronous transfer orbits on either the first ascending or descending leg. Following payload separation, the LV shall perform a collision and contamination avoidance maneuver (CCAM).

DoD PORTION	PAYLOAD	ORBIT	LAUNCH WT(LBS)	APOGEE (NM)	PERIGEE (NM)	INCLINATION (DEGREES)	NOTES
AFSPC	ADV MILSATCOM	GTO	8500	19300	100	27	6
	DSCS	GTO	6300	19196	127	25.5	7
	DSP	GEO	5402	19323	19323	3	
	GPS IIF	SEMI SYNC	4725	10998	100	55	2
	SBIRS LEO	LEO	8175	378	378	54.7	3
	SBIRS GEO	GTO	8500	19324	90	27	
Other	Mission A	**					
	Mission C	**					
NASA							
	DISCOVERY	PLNTRY	2000	N/A	N/A	28.5	4

*** Launch weight includes the weight of the separated space vehicle, the space vehicle to launch vehicle adapter (if supplied by the space vehicle), and all other unique hardware required on the launch vehicle to support the space vehicle's mission.**
**** Reference classified SPRD Addendum**

1 - Direct injection orbit .
2 - SPRD to allow delivery to transfer orbit (4725 lbs to 55 degrees) with spin stabilization or to final orbit (2675 lbs at 10,998 nmi circular orbit at 55 degree inclination) at EELV ktr's option; EELV provides spin table, unless direct insertion option is used; GPS provides SV destruct system.
3 - SBIRS LEO spacecraft will be launched 3 at a time. Launch weight is combined weight of all 3 s/c with adapter. Data reflects parking orbit. Transfer to final orbit (864 NM at 54.7 degree inclination) will be done using SV propellant
4. - Launch Energy C3=17 km^2/sec^2
5 - For the first TSX-8 mission in FY02 the payload launch weight (TBD) will be compatible with the MLV lift capability to the delivery orbit (TBD) when launched from either ER or WR.
6 - AdvMilsatCom includes two space vehicle systems (Advanced EHF and Advanced SHF K/a). Mission model data is the same but orbital parameter accuracy varies (see Table 2).
7 - DSCS orbital parameters are applicable to the first ascending node.

Table 1: Unclassified Government Reference Missions

3.1.1.2 Performance Margin.

Performance margin is the amount of additional performance capability a vehicle has above the required mission need at the time of launch. EELV shall have a threshold performance margin of 7% MLV and 2% for the HLV over the KPP for mass to orbit listed in Table 1 above. The government intends to reserve 5% of the performance margin as useable payload growth capability for MLV government payloads.

3.1.1.3 Flight Performance Reserve

EELV performance shall provide a 3σ (99.865%) assurance of the vehicle fully meeting mass to orbit requirements (including performance margin capabilities) while considering possible uncertainties in EELV and environmental parameters such as propellant loading, Isp, and atmospheric density.

3.1.1.4 Orbital Parameter Accuracy

The accuracy at the final orbit injection point for each payload mission is defined by the following six variables: apogee, perigee, inclination, argument of perigee, LAN and RAAN, these values are defined in the table below and reflect the payload customer's requirements. The EELV shall have orbital parameter accuracies within these 3 sigma values (threshold).

	Apogee (nmi)	Perigee (nmi)	Inc (deg)	ArgPer (deg)	LAN (deg)	RAAN (deg)
ADVMIL (EHF) *	±100	±4.0	±0.1	±0.3	N/A	±0.75
ADVMIL (SHF) *	±70	±4.0	±0.1	±0.4	±0.5	N/A
DSCS	±70	±4.0	±0.1	±0.4	±0.5	N/A
DSP ***	N/A	N/A	N/A	N/A	N/A	N/A
GPSIIF/Transfer	±210	±4	±0.4	TBD	N/A	±0.2
GPSIIF/Direct to Orbit	±210	0.0 ± .02 ****	± 1	TBD	± 2	Variable
SBIRS LEO	TBD	TBD	TBD	TBD	TBD	TBD
SBIRS GEO	TBD	TBD	TBD	TBD	TBD	TBD
TSX	TBD	TBD	TBD	TBD	TBD	TBD
DISCOVERY	TBD	TBD	TBD	TBD	TBD	TBD
Mission A	**	**	**	**	**	**
Mission B	**	**	**	**	**	**
Mission C	**	**	**	**	**	**
Mission D	**	**	**	**	**	**
Mission E	**	**	**	**	**	**

* For AdvMilSatCom these values are for insertion into GTO
** See requirements in classified SPRD Addendum
*** DSP orbital requirements do not specify accuracy; however, Inclination (2.5-3.0 degrees) is optimized
**** For GPSIIF Direct to Orbit this value is Eccentricity

Table 2: Orbital Parameter Accuracies

3.1.2 Vehicle Design Reliability*

For all missions, EELV vehicles shall have a vehicle design reliability of 0.98 (threshold), at 50% confidence level.

3.1.2.1 Mission Reliability

Mission reliability, measured from launch commit, is the probability of successfully placing the payload into its delivery orbit with the required delivery accuracy and then executing a CCAM. Mission reliability takes into account both vehicle design and process reliabilities. Vehicle design reliability accounts for potential mission failure modes that have their genesis in the design of system hardware, component integration architecture, and software (including those pertaining to staging events and CCAMs). Process reliability includes consideration of failure modes introduced by manufacturing, infrastructure, assembly, ground processing, and system integrating activities (including payload mating activities performed by EELV). For all MLV missions, EELV shall have a mission reliability of 0.975, at 50% confidence level. For HLV flights to GEO and LEO Polar, EELV shall have a mission reliability of 0.97 at 50% confidence level.

3.1.2.2 In-Flight Data

The launch vehicle shall telemeter key data from launch through the completion of CCAM and disposal operations (compatible with range equipment). Key data is defined as all data necessary to 1) support range safety requirements, 2) verify system/subsystem performance, 3) verify payload environments, and 4) enable rapid post-flight diagnosis of anomalies/failures. Accordingly, the objective is to obtain telemetry in as near real time as possible. Using these data the EELV system shall provide a quick-look data report within two hours of completion of CCAM and/or disposal operations following data receipt at an EELV facility. A complete post-flight analysis and report shall be provided within seven working days of completion of CCAM and/or disposal operations.

3.1.3 Standardization

3.1.3.1 Launch Pads*

Launch pads shall be able to launch all configurations of EELV required to support the missions identified in Table 1 to be launched from that site.

3.1.3.2 Payload Interfaces*

The EELV system shall have a single standard interface for each vehicle class in the EELV family. Unique payload mounting or multiple-manifested-satellite-dispensing requirements will be satisfied with a payload-provided adapter to the standard interface or dispenser, and these items shall be considered a part of the payload mass. Specific standard interface requirements are contained in Annex 15 of the RFP. Furthermore, EELV shall accommodate all mission unique requirements identified in the mission unique annex.

3.1.4 Timeliness (Schedule Dependability)

The EELV shall consistently launch on time based on need and schedule. Given the system is not in a stand down mode, the EELV shall provide at least an 0.80 probability of launching (within a designated launch window) no more than 10 calendar days after the accountable launch date confirmed 90 days prior.

3.1.5 Responsiveness (Call Up and Payload Substitution)

EELV shall support the call up of unscheduled launches and payload substitution for pre-integrated (first time integration complete) payloads. Once a launch date is established, the system shall meet the timeliness requirement in response to an unscheduled launch or payload substitution.

3.1.5.1 Call-up (Unscheduled Launch)

The system shall be capable of responding to emergency or unforeseen launch requirements. The call up response time is 45 days for medium vehicles and 90 days for the heavy vehicle. It is allowable that normal processing be accelerated or modified to meet the call-up mission.

3.1.5.2 Payload Subsititution

The system shall provide the capability to substitute a payload (ready for encapsulation on the same configuration) prior to mating of the original planned mission payload, with minimal impact to the launch schedule. Payloads substituted for a mated payload shall be launched within 45 days of notification of substitution. Payload substitution (not requiring removal of a previously mated payload) should not drive additional launch site processing other than normal payload mate activities.

3.1.6 Basic Launch Rate

The EELV system shall have the capacity to provide 12 launches at CCAS, which may include one heavy mission. EELV shall be capable of achieving the Basic Launch Rate as a normal course of operations with routine maintenance. The launch rate must be achievable taking into account maintenance of the system and its infrastructure, weather delays, launch range conflicts with other spacelift systems, and other typical launch delays.

3.1.7 Range Interfaces

EELV shall be compatible with the existing range infrastructure and plan for compatibility with future range upgrades. The system shall interface and be compatible with current spacelift ranges and their existing infrastructure, if they are used, including facilities and equipment for integration, check-out, processing, Telemetry Tracking and Commanding (TT&C) and launch operations. The system shall plan for compatibility with future range upgrades under the Range Standardization and Automation (RSA) program. Once certified, the Global Positioning System (GPS) will be the EELV range safety metric tracking system. Until the GPS system is certified as the tracking source at both ranges, EELV shall be capable of carrying and operating GPS and C-Band simultaneously. EELV shall have sufficient signal strength and be compatible with current ground, airborne, and space based telemetry relay systems if they are used.

3.1.8 Supportability/Maintainability

The EELV system shall be sufficiently maintainable to allow meeting launch rate and schedule dependability requirements. Where appropriate and necessary, contractor data systems for supply and support maintenance data collection shall be interoperable with those of the Air Force logistics systems. Equipment owned, operated and/or maintained by the government must be supported using the standard Air Force logistics infrastructure. The EELV Contractor may use the Air Force Core Automated Maintenance System (CAMS) or a designated follow-on for contractor owned, operated and/or maintained equipment. Air Force personnel shall be provided electronic access to Contractor maintenance management information systems if CAMS is not used. The contractor shall have a technical library on site and supply access to both government and contractor personnel for all contractor technical data and processes necessary to operate and process the system

3.1.9 Type 1 Training

For all EELV tasks requiring insight by government personnel, the contractor shall provide course materials (e.g. lesson plans, study guides, and tests) and contractor training courses, seminars, on-the-job training, or equivalents. The contractor shall provide all or parts of the necessary equipment and logistics support for all Type 1 training devices. The training facilities used for Type 1 training will be contractor provided. The government's Type 1 training requirements shall include minimal differences from the same training provided contractor personnel. The Type 1 training materials and training equipment shall be used to implement, supplement, and/or augment an organic AF training capability.

3.1.10 Safety

Space Wing safety, contractor safety, and maintenance controllers will help ensure EELV contractor compliance with range safety requirements and support mishap investigations (in accordance with AFI 91-204, Safety Investigations and Reports) as necessary. HQ AFSPC will provide the ranges with policy and safety compliance as necessary.

3.1.10.1 System Safety

The EELV program shall include a system safety program with the objectives being to minimize loss of personnel and resources due to mishaps and preserve the spacelift capability of the Air Force by ensuring system safety is applied throughout a system life cycle. EWR 127-1 shall be tailored for the EELV program. The EELV system shall comply with the tailored EWR 127-1 or obtain appropriate deviations or waivers. EWR 127-1 specifies that new programs and major program modifications require phased safety reviews at critical milestones such as at concept, preliminary, and critical design reviews, and 120 days prior to shipment to either range. Refer to EWR 127-1 for detailed compliance requirements.

3.1.11 System Security

The system shall comply with the intent of AFI 31-101, The Air Force Physical Security Program, and as supplemented by AFSPC. The system will also comply with the intent of the 31 series of policy directives and instructions applicable to the system. Data and communication systems carrying sensitive/critical/classified information shall be protected from disclosure, intrusion, and other forms of information warfare. Physical security countermeasures shall protect against compromise or loss of information and resources due to unauthorized access to facilities, equipment, payloads, data, and shall protect operations against technology transfer, espionage, sabotage, damage, tampering, and theft. Data and communication links carrying classified information, up to and including Top Secret/Sensitive Compartmentalized Information, shall be protected according to NSA and Air Force COMSEC requirements from disclosure, intrusion, and other forms of information warfare. Data and communication links carrying sensitive unclassified and critical information shall be protected according to its sensitivity or criticality level from disclosure, intrusion, and other forms of information warfare***.***

3.1.12 Recovery and Disposal Requirements

The system shall provide for safe disposal (including trajectory and debris dispersions) or recovery of all the spacelift system vehicle components and all non-deployed payload equipment. Based on existing mandates, disposal or recovery from low earth orbit or suborbital trajectories shall be in accordance with international agreements.

3.1.12.1 Orbital Debris

EELV shall comply with National, DoD and USSPACECOM orbital debris minimization policies to minimize residual orbital debris after launch. The LV stages which are orbital shall be safely deorbited <u>whenever practical</u>. Stages and/or components shall be designed to minimize their break-up characteristics due to explosions, hypervelocity collisions, and the effects of space environment. Where practical, EELV shall incorporate space debris minimization features. Pressurized components shall be vented and otherwise designed to minimize the likelihood of explosion if not deorbited.

3.1.13 Environmental Requirements

The EELV system shall operate within applicable laws and regulations without waivers and minimize the use and generation of hazardous materials at all sites to include launch and manufacturing sites (contractor and subcontractor).

3.1.13.1 Hazardous Materials Management

The EELV system shall not use materials designated as Class I Ozone-Depleting Substances (ODSs) in manufacturing, maintenance, launch processing or system disposal. The design shall identify, justify, minimize and/or eliminate requirements for the usage of Class II ODSs, and EPCRA Section 313 chemicals.

3.2 Capabilities Required (West Coast - Protected HLV Capability)

This section applies to a system that is proposed to provide a medium lift capability at the West Coast while protecting a West Coast heavy lift capability. The EELV system must meet all requirements listed in Section 3.1, Capabilities Required (System and East Coast), in addition to those indicated below.

3.2.1 Performance (Mass-to-Orbit)*

The threshold requirement is to deliver the required mass to the desired orbit of the payloads indicated in Table 3 to include all classified payloads (reference SPRD

Annex). Following payload separation, the LV shall perform a collision and contamination avoidance maneuver (CCAM).

DoD PORTION	PAYLOAD	ORBIT	LAUNCH WT(LBS)	APOGEE (NM)	PERIGEE (NM)	INCLINATION (DEGREES)	NOTES
AFSPC	DMSP	POLAR	3300	458	458	98.7	1
Other DoD	TSX	POLAR	6000	500	500	90	5
	NPOESS	POLAR	6840	450	450	98.2	
OTHER	MISSION B	**					
	MISSION D	**					
	MISSION E	**					
NASA	EOS PM	SUN-SYNC	7000-8000	380	380	98.2	
	EOS CHEM	SUN-SYNC	7900	380	380	98.2	

*** Launch weight includes the weight of the separated space vehicle, the space vehicle to launch vehicle adapter (if supplied by the space vehicle), and all other unique hardware required on the launch vehicle to support the space vehicle's mission.**
**** Reference Classified SPRD Addendum**
1 - Direct injection orbit.
2 - SPRD to allow delivery to transfer orbit (4725 lbs to 55 degrees) with spin stabilization or to final orbit (2675 lbs at 10,998 nmi circular orbit at 55 degree inclination) at EELV ktr's option; EELV provides spin table, unless direct insertion option is used; GPS provides SV destruct system.
3 - SBIRS LEO spacecraft will be launched 3 at a time. Launch weight is combined weight of all 3 s/c with adapter. Data reflects parking orbit. Transfer to final orbit (864 NM at 54.7 degree inclination) will be done using SV propellant
4. - Launch Energy C3=17 km^2/sec^2
5 - For the first TSX-8 mission in FY02 the payload launch weight (TBD) will be compatible with the MLV lift capability to the delivery orbit (TBD) when launched from WR.
6 - AdvMilsatCom includes two space vehicle systems (Advanced EHF and Advanced SHF K/a). Mission model data is the same but orbital parameter accuracy varies (see Table 2).
7 - DSCS orbital parameters are applicable to the first ascending node.

Table 3: Unclassified Government Reference Missions

3.2.1.1 Performance Margin

Performance margin is the amount of additional performance capability a vehicle has above the required mission need at the time of launch. EELV shall have a threshold performance margin of 7% MLV and 2% for the HLV over the KPP for mass to orbit listed in Table 3 above. The government intends to reserve 5% of the MLV performance margin as useable payload mass growth capability for government payloads.

3.2.1.2 Flight Performance Reserve

EELV performance shall provide a 3σ (99.865%) assurance of the vehicle fully meeting mass to orbit requirements (including performance margin capabilities) while considering possible uncertainties in EELV and environmental parameters such as propellant loading, Isp, and atmospheric density

3.2.1.3 Performance: Orbital Parameter Accuracy

The accuracy at the final orbit injection point for each payload mission is defined by the following six variables: apogee, perigee, inclination, argument of perigee, LAN and RAAN, these values are defined in Table 4 and reflect the payload customer's requirements. The EELV shall have orbital parameter accuracies within these 3 sigma values (threshold).

	Apogee (nmi)	Perigee (nmi)	Inc (deg)	ArgPer (deg)	LAN (deg)	RAAN (deg)
DMSP	±9	±7	±0.1	Variable	Variable	Variable
TSX	TBD	TBD	TBD	TBD	TBD	TBD
NPOESS	TBD	TBD	TBD	TBD	TBD	TBD
EOS PM	TBD	TBD	TBD	TBD	TBD	TBD
EOS CHEM	TBD	TBD	TBD	TBD	TBD	TBD
Mission B	**	**	**	**	**	**
Mission D	**	**	**	**	**	**
Mission E	**	**	**	**	**	**

** See requirements in Classified SPRD Addendum

Table 4: Orbital Parameter Accuracies

3.2.2 Basic Launch Rate

The EELV system shall have the capacity to provide 6 launches at VAFB, which may include one heavy mission. EELV shall be capable of achieving the Basic Launch Rate as a normal course of operations with routine maintenance. The launch rate must be achievable taking into account maintenance of the system and its infrastructure, weather delays, launch range conflicts with other spacelift systems, and other typical launch delays.

3.2.3 Standard Launch Pads*

West Coast system launch pad shall be constructed to structurally support all vehicle configurations necessary to support all reference missions in Table 3. This includes launch table (mount), flame ducts and vehicle component transportation routes. Processing facilities located on the launch complex must be sized to accommodate vehicle configurations supporting all west coast reference missions.

3.2.4 Launch Vehicle Segment

The launch vehicle segment, as a minimum, shall provide a complete capability to meet all mission requirements in Table 3 except reference Mission D. The design for reference mission D shall be completed through a critical design review.

3.2.5 Heavy Lift Call Up(Exercise of HLV Launch Service Option)

The system shall be capable of supporting heavy lift operations at the West Coast within 24 months of HLV call up. This includes completion and qualification of vehicle design and launch site activation.

3.3 Capabilities Required (West Coast - Full MLV/HLV Capability)

This section applies to a system that is proposed to provide a full system capability (MLV/HLV) at the West Coast. The West Coast EELV system must meet all requirements listed in Section 3.1, Capabilities Required (System and East Coast), in addition to those below.

3.3.1 Performance (Mass-to-Orbit)*

The threshold requirement is to deliver the required mass to the desired orbit of the payloads indicated in Table 5 to include all classified payloads (reference classified SPRD Addendum). Following payload separation, the LV shall perform a collision and contamination avoidance maneuver (CCAM).

DoD PORTION	PAYLOAD	ORBIT	LAUNCH WT(LBS)	APOGEE (NM)	PERIGEE (NM)	INCLINATION (DEGREES)	NOTES
AFSPC	DMSP	POLAR	3300	458	458	98.7	1
Other DoD	TSX	POLAR	6000	500	500	90	5
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OTHER	MISSION B	**					
	MISSION D	**					
	MISSION E	**					
NASA	EOS PM	SUN-SYNC	7000-8000	380	380	98.2	
	EOS CHEM	SUN-SYNC	7900	380	380	98.2	

*** Launch weight includes the weight of the separated space vehicle, the space vehicle to launch vehicle adapter (if supplied by the space vehicle), and all other unique hardware required on the launch vehicle to support the space vehicle's mission.**

1 - Direct injection orbit.

2 - SPD to allow delivery to transfer orbit (4725 lbs to 55 degrees) with spin stabilization or to final orbit (2675 lbs at 10,998 nmi circular orbit at 55 degree inclination) at EELV ktr's option; EELV provides spin table, unless direct insertion option is used; GPS provides SV destruct system.

3 - SBIRS LEO spacecraft will be launched 3 at a time. Launch weight is combined weight of all 3 s/c with adapter. Data reflects parking orbit. Transfer to final orbit (864 NM at 54.7 degree inclination) will be done using SV propellant

4. - Launch Energy C3=17 km^2/sec^2

5 - For the first TSX-8 mission in FY02 the payload launch weight (TBD) will be compatible with the MLV lift capability to the delivery orbit (TBD) when launched from WR.

6 - AdvMilsatCom includes two space vehicle systems (Advanced EHF and Advanced SHF K/a). Mission model data is the same but orbital parameter accuracy varies (see Table 2).

7 - DSCS orbital parameters are applicable to the first ascending node.

Table 5: Unclassified Government Reference Missions

3.3.1.1 Performance Margin

Performance margin is the amount of additional performance capability a vehicle has above the required mission need at the time of launch. EELV shall have a threshold performance margin of 7% MLV and 2% for the HLV over the KPP for mass-to-orbit listed in Table 5 above. The government intends to reserve 5% of the performance margin as useable payload growth capability for government payloads.

3.3.1.2 Flight Performance Reserve

EELV performance shall provide a 3σ (99.865%) assurance of the vehicle fully meeting mass-to-orbit requirements (including performance margin capabilities) while considering possible uncertainties in EELV and environmental parameters such as propellant loading, Isp, and atmospheric density

3.3.1.3 Performance: Orbital Parameter Accuracy

The accuracy at the final orbit injection point for each payload mission is defined by the following six variables: apogee, perigee, inclination, argument of perigee, LAN and RAAN, these values are defined in Table 6 below and reflect the payload customer's requirements. The EELV shall have orbital parameter accuracies within these 3 sigma values (threshold).

	Apogee (nmi)	Perigee (nmi)	Inc (deg)	ArgPer (deg)	LAN (deg)	RAAN (deg)
DMSP	±9	±7	±0.1	Variable	Variable	Variable
TSX	TBD	TBD	TBD	TBD	TBD	TBD
NPOESS	TBD	TBD	TBD	TBD	TBD	TBD
EOS PM	TBD	TBD	TBD	TBD	TBD	TBD
EOS CHEM	TBD	TBD	TBD	TBD	TBD	TBD
Mission B	**	**	**	**	**	**
Mission D	**	**	**	**	**	**
Mission E	**	**	**	**	**	**

** See requirements in SPD Classified Annex

Table 6: Orbital Parameter Accuracies

3.3.2 Basic Launch Rate

The EELV system shall have the capacity to provide 6 launches at VAFB, which may include one heavy mission. EELV shall be capable of achieving the Basic Launch Rate as a normal course of operations with routine maintenance. The launch rate must be achievable taking into account maintenance of the system and its infrastructure, weather delays, launch range conflicts with other spacelift systems, and other typical launch delays.

3.3.3 Standard Launch Pads*

Launch pads shall be able to launch all configurations of EELV required to support the missions identified in Table 5 to be launched from that site.

4. SYSTEM OBJECTIVES

4.1 Development

This section contains design characteristics to be considered in the development of the EELV system. These characteristics are not program requirements, but objectives for the contractor to reference during development. EELV contractors are not bound by the guidelines in this section and may offer alternative design solutions.

4.2 Capabilities

This section contains capabilities beyond the minimum system requirements (contained in section three) the government has identified as beneficial. The system is not required to meet these objectives. However if the system exceeds minimum requirements, these objectives are available to be used by the contractor in conducting system trades.

4.2.1 Performance Margin

Performance margin is the difference between the lift capability indicated by a 3σ-assurance performance estimation technique and the usable lift of an EELV vehicle. It is the degree to which the system approach or hardware design enables an increment in performance capabilities of the spacelift system without necessitating unplanned redesigns of hardware or operations. Performance margin will be used by the government for payload mass growth and mission performance assurance. EELV shall have a performance margin objective of 20% for the MLV and 10% for the HLV.

4.2.2 Payload Volume Growth

EELV should have a planned Payload Volume Growth objective of at least 10% at a constant diameter.

4.2.3 Payload Encapsulation

As an objective, mating of the encapsulated SV and final preparation for launch should be conducted off-pad.

4.2.4 Launch Rate

EELV should improve over current processing timelines for: (1) assembly and checkout of launch vehicles; (2) mechanical and electrical mating of spacecraft with the launch vehicle; (3) checkout and maintenance of the launch pad and launch processing facilities; (4) checkout of the integrated vehicle and verification of payload interfaces; (5) fueling and final checkout of the launch vehicle at the launch pad; and (6) verification of range interfaces.

4.2.4.1 Resiliency

Resiliency is measured as the maximum sustainable (two shift operations; three shifts during launch countdown) launch rate with scheduled maintenance. It facilitates the timely, efficient, and dependable execution of the national space launch mission. EELV should be resilient enough to recover on a timely basis from a downing event or other delays which could cause the system to not meet the government portion of the EELV

Mission Model resiliency capability available at FOC should, as an objective, provide for 5 additional launches (2 medium and 1 heavy, East Coast; 1 medium and 1 heavy, West Coast) above the Basic Launch Rate.

4.2.4.2 Crisis Response

A crisis could require an increase in launch rates above the maximum sustainable (resilience) rate to provide on-orbit support to the warfighter. Crisis response will allow the insertion of payloads into the schedule with minimal delay of previously scheduled payloads. The increased launch rate required for crisis response and subsequent schedule recovery is for a short duration and not sustainable. EELV crisis response capability available at FOC should, as an objective, enable the call up and launch of 3 crisis-response medium payloads (2 East and 1 West) within a 2 month period every 12 months from each site and be back on schedule within 6 months (assuming the current schedule is at the maximum sustainable launch rate). Schedule time allocated for scheduled facility maintenance can be postponed to accommodate a crisis response or to facilitate subsequent schedule recovery.

4.2.4.3 Launch Recycle

As an objective, the system should be capable of rapidly reentering the launch countdown, after recycles or holds, in order to maximize the number of launch attempts per window.

4.2.5 Responsiveness (Call Up)

EELV as an objective should support an unscheduled DoD launch within 30 days for medium vehicles and 60 days for heavy vehicles. This time interval includes processing the vehicle, mating the launch vehicle with the payload, and conducting launch operations. An unscheduled launch must still meet the timeliness requirement.

4.2.6 Timeliness (Schedule Dependability)

EELV should be robust enough to be minimally affected by outside influences such as weather conditions, daylight restrictions and electromagnetic radiation, or by component/equipment failures during launch processing. Given the system is not in a stand down mode, the EELV should provide at least an 0.90 probability of launching (within a designated launch window) no more than 10 calendar days after the accountable launch date confirmed 90 days prior.

4.2.7 Infrastructure.

As an objective, the infrastructure should provide standard equipment and processes to support the launch of the EELV.

4.2.8 Standard Launch Vehicles

The system should incorporate commonality between medium and heavy lift variants to the maximum extent practical. Launch vehicle elements for each vehicle class should be useable independent of the particular mission being flown. Performance analyses and performance margins for the EELV design should consider unit-to-unit variability of launch vehicle elements (e.g. engines, motors). As an objective, there should be one payload interface for all vehicles in the EELV family.

ACRONYMS AND ABBREVIATIONS

AFOSH	Air Force Occupational Safety and Health
AFSPC	Air Force Space Command
AGE	Aerospace Ground Equipment
ASE	Airborne Support Equipment
CCAM	Collision, Contamination Avoidance Maneuver
CCAS	Cape Canaveral Air Station
COMSEC	Communications Security
DC	Direct Current
DoD	Department of Defense
EELV	Evolved Expendable Launch Vehicle
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMISM	EMI Safety Margin
EPA	Environmental Protection Agency
EWR	Eastern and Western Range Regulation
GEO	Geosynchronous Earth Orbit
GFE	Government Furnished Equipment
GPS	Global Positioning System
GTO	Geosynchronous Transfer Orbit
HLV	Heavy Lift Variant
HQ	Headquarters
LAN	Longitude of Ascending Node
LEO	Low Earth Orbit
LV	Launch Vehicle
MLV	Medium Lift Variant
N/A	Not Applicable
NMI	Nautical Miles
NMM	National Mission Model
NSA	National Security Agency
ODS	Ozone Depleting Substance
ORD	Operational Requirements Document
OSHA	Occupational Safety and Health Administration
RAAN	Right Ascension of Ascending Node
RF	Radio Frequency
RPM	Revolutions Per Minute
RSA	Range Standardization and Automation
SER	Safety Equivalency Report
SPRD	System Performance Requirements Document
T	Launch Countdown Time
TBD	To Be Determined
TT&C	Tracking, Telemetry & Commanding
VAFB	Vandenberg Air Force Base